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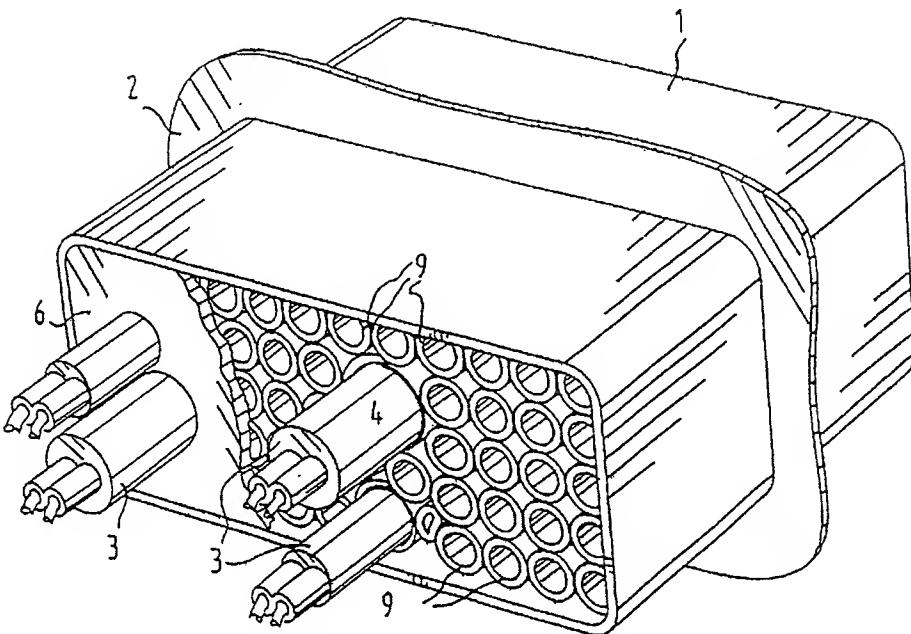
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(54) Title: FIRE-RESISTANT SYSTEM AND METHOD FOR PASSING AT LEAST ONE CABLE, TUBE OR THE LIKE THROUGH AN OPENING IN A WALL



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(57) Abstract: A fire-resistant system for passing at least one cable, tube or the like through an opening in a wall, which system comprises a fire-resistant sleeve member comprising a continuous slit, which is at least partially arranged round said at least one cable, tube or the like, and which is at least partially installed in said opening, characterized in that the sleeve member can be placed in a position in which longitudinal edges of said slit overlap permanently under material stress.



*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

FIRE-RESISTANT SYSTEM AND METHOD FOR PASSING AT LEAST ONE CABLE, TUBE OR THE LIKE THROUGH AN OPENING IN A WALL.

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The invention relates to a fire-resistant system for passing at least one cable, tube or the like through an opening in a wall. The invention also relates to a method for passing at least one cable, tube or the like through an opening in a 10 wall, using the aforesaid system. Hereinafter, the term "wall" will be used for the sake of simplicity, whilst said term is understood to include other partitions as well, such as bulkheads, division plates and the like.

15 Such a system and such a method are known from European patent publication No 0 534 563 of the present Applicant. The bushing system that is disclosed therein consists of a steel bushing mounted in an opening in a wall, through which a number of cables, which may or may not be multiple cables, 20 are passed. Each cable is enclosed in a rubber sleeve member or hose member, whilst the remaining space in the wall opening is filled with similar hose members. Finally, the wall opening is sealed with a suitable sealing putty. The hose members are provided with a continuous slit so as to 25 make it easier to arrange the hose members round the cables that have already been drawn.

One drawback of this known system and this known method is that several sleeve members or hose members having varying 30 diameters are required if various types of cables having varying diameters are passed through the opening in the wall. After all, each type of cable diameter requires its own

corresponding type of hose member diameter. It stands to reason that the manufacture, the transport and the storage of various types of hose members is found to be laborious, whilst it must be determined upon installation at the 5 building site which type of hose member fits which type of cable, which stands in the way of an efficient installation process.

The object of the invention is to improve the system 10 disclosed in the aforesaid European patent specification in the sense that the drawbacks as indicated above are overcome.

In order to accomplish that objective, a bushing system of the kind referred to in the introduction is according to the 15 invention characterized in that the sleeve member can be placed in a position in which longitudinal edges of said slit overlap permanently under material stress. The advantage of this is that one type of sleeve member or hose member will suffice in spite of the fact that different cable diameters 20 are used. An important feature of the sleeve member, which is preferably made from a resilient material, is the fact the resilience of the material makes it possible to place the sleeve member in various positions, in which the extent to which the longitudinal edges of the continuous slit overlap 25 varies with each different position. In other words, the effective diameter of the sleeve member can be varied by reducing or increasing the extent to which the longitudinal edges overlap in dependence on the diameter of a respective cable being passed through. It is noted that the term 30 "permanent overlap" in this connection is understood to mean that the longitudinal edges of the continuous slit do not automatically spring back from the position in which they

overlap to a position in which they no longer overlap and consequently lie opposite each other, for example due to stresses in the material. As already said before, the sleeve member or hose member can be deformed in such a manner that

5 the longitudinal edges of the continuous slit take up a desired overlapping position and remain in that position, which position corresponds to a diameter of a respective cable passed through the wall opening. Several cables, tubes or the like may be drawn through by one hose member.

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In one preferred embodiment of the system according to the invention, the longitudinal edges overlap 1 - 5 cm, in particular 2 - 4 cm. Experiments have shown that this makes it possible to use the sleeve member with practically any

15 cable diameter.

In another preferred embodiment of a system according to the invention, the fire-resistant sleeve member is at least substantially made from a fire-resistant rubber. The rubber 20 is an elastomer or a plastomer, in particular EVA rubber, EVA standing for Ethylene/Vinyl/Acetate. In a preferred variant, the fire-resistant rubber can expand under the influence of heat, so that a sufficient degree of "tightness" is realised in the opening. A further important advantage of said the 25 expansion is the fact that a longer and thus more fire-resistant "bushing mass" is obtained.

In another preferred embodiment of a system according to the invention, several second fire-resistant sleeve members are 30 provided, which sleeve members extend in the same direction as the first sleeve member arranged round said at least one cable, tube or the like and which fill the remaining space in

the opening. As a result of the presence of said "fire-resistant filling means" a sufficient degree of air inclusion in the opening, and thus a high thermal insulation, is obtained. In particular, said first and said second sleeve members are identical, so that only one type of sleeve member or hose member is present at the building site, which facilitates and simplifies the installation of the present system considerably.

10 In another preferred embodiment of a system according to the invention, said second fire-resistant sleeve members are at least substantially made from a fire-resistant rubber, and they are bonded together. The rubber is preferably of the kind as already explained above with regard to the first  
15 sleeve member. The bonding together into one "unit" of the sleeve members functioning as "fillers" leads to the advantage that the remaining space in the opening does not need to be filled with the hose members one by one, but that said space can be filled with only one or a few "units",  
20 which considerably enhances the efficiency of the installation. This aspect of the invention may also be applied independently of the specific embodiment of the aforesaid sleeve member, for example in the system disclosed in the aforesaid European patent publication No 0 534 563,  
25 and consequently it constitutes an invention that may be claimed separately.

In another preferred embodiment of a system according to the invention, a heat-resistant and/or liquid-repellent material  
30 is provided, which material is sealingly arranged on at least one open side of the opening. Said heat-resistant and/or liquid-repellent sealing putty enhances the liquid-tightness

and gas-tightness of the system. Preferably, said putty is expandable under the influence of heat.

A method for passing at least one cable, tube or the like 5 through an opening in a wall, using a system according to the invention, comprises the following steps:

- passing said at least one cable, tube or the like through the opening,
- arranging a sleeve member comprising a continuous slit 10 whose longitudinal edges overlap permanently under material stress at least in part round a portion of said at least one cable, tube or the like present, at least in part, in said opening.

15 The method preferably also comprises the step of filling the remaining space in the opening with second sleeve members or hose members, as well as the step of sealingly providing a heat-resistant and/or liquid-repellent material on at least one open side of the opening.

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The invention will now be explained in more detail with reference to figures illustrated in a drawing, in which:

- Figure 1 is a schematic, perspective view of a preferred 25 variant of a system according to the invention;
- Figure 2 is a schematic, perspective view of a hose member used in the system of Figure 1, which hose member is arranged round a cable being passed through; and
- Figure 3 shows several bonded-together hose members used 30 as fillers in the system of Figure 1.

Figure 1 shows a frame 1 which is mounted in an opening formed in a steel deck or bulkhead of a vessel. The frame 1 comprises a flange 2, which lies in the plane of the steel deck and which functions as a support. After the frame 1 has 5 been sealingly mounted in the opening, electric lines 3 having varying diameters are drawn through the frame 1. Following that, a sleeve 4 of a fire-resistant rubber according to the invention is arranged round each electric line 3. Said arranging of the round cables having varying 10 diameters is easier when said one type of sleeve 4 is used, since the sleeves 4 are provided with a continuous slit 5, whose longitudinal edges 7 overlap, as will be explained in more detail yet with reference to Figure 2. Then the 15 remaining space in the frame 1 is filled with sleeves 9 of the same type of fire-resistant rubber. Finally, a heat-resistant and/or water-repellent sealing putty 6 is provided on both open sides of the frame 1. Said putty 6 has been selected because it has good bonding properties and because it will cure into a rubbery material within 24 hours as a 20 result of the atmospheric humidity. Preferably, the putty 6 is expandable under the influence of fire. The heat-resistant and/or water-repellent putty 6 guarantees a watertight and gastight bushing of the electric lines 3. It is noted that the sealing putty 6 is partially left out in Figure 1 so as 25 not to complicate Figure 1 unnecessarily.

Figure 2 shows that the effective diameter of a sleeve 4 can be adapted to the diameter of a respective electric line 3 by changing the degree of overlap of the longitudinal edges 7 30 accordingly. The resilience of the fire-resistant rubber is such that the longitudinal edges 7 will not automatically spring back when the desired degree of overlap is reached and

will remain in said desired position, therefore. The distance by which the longitudinal edges overlap and along which the sleeve 4 has a double thickness, therefore, ranges in particular from 2 to 4 cm. In order to avoid said double thickness, it is preferred to make the longitudinal edges 7 conical, so that they will have a joint thickness equal to a normal thickness of the sleeve 4 in the position in which they overlap.

10 Figure 3 shows a group of six bonded-together sleeves 9 forming one "unit", which function to fill the remaining space in the opening of the frame 1. This enables quicker and simpler filling of said space, since it is no longer necessary to place the sleeves into said space one by one as 15 was previously the case. The sleeves 9 are provided with an adhesive at their contact surfaces 8 and do not have a continuous slit.

The invention is not limited to the preferred variant as 20 shown, but it also extends to other variants that fall within the scope of the appended claims.

## CLAIMS

1. A fire-resistant system for passing at least one cable, tube or the like through an opening in a wall, which system comprises a fire-resistant sleeve member comprising a continuous slit, which is arranged at least in part round said at least one cable, tube or the like, and which is installed at least in part in said opening, characterized in that the sleeve member can be placed in a position in which longitudinal edges of said slit overlap permanently under material stress.
2. A fire-resistant system according to claim 1, wherein the longitudinal edges overlap 1 - 5 cm, in particular 2 - 4 cm.
3. A fire-resistant system according to claim 1 or 2, wherein the fire-resistant sleeve member is at least substantially made from a fire-resistant rubber.
4. A fire-resistant system according to claim 1, 2 or 3, wherein several second fire-resistant sleeve members are provided, which sleeve members extend in the same direction as the first sleeve member arranged round said at least one cable, tube or the like and which fill the remaining space in the opening.
5. A fire-resistant system according to any one of the preceding claims 1 - 4, wherein said second fire-resistant sleeve members are at least substantially made from a fire-resistant rubber, and they are bonded together.

6. A fire-resistant system according to any one of the preceding claims 1 - 5, wherein a heat-resistant and/or liquid-repellent material is provided, which material is 5 sealingly arranged on at least one open side of the opening.

7. A method for passing at least one cable, tube or the like through an opening in a wall, using a system according to according to any one of the preceding 10 claims 1 - 6, which method comprises the following steps:

- passing said at least one cable, tube or the like through the opening,
- 15 - arranging a sleeve member comprising a continuous slit whose longitudinal edges overlap permanently under material stress at least in part round a part of said at least one cable, tube or the like being present, at least in part, in said opening.

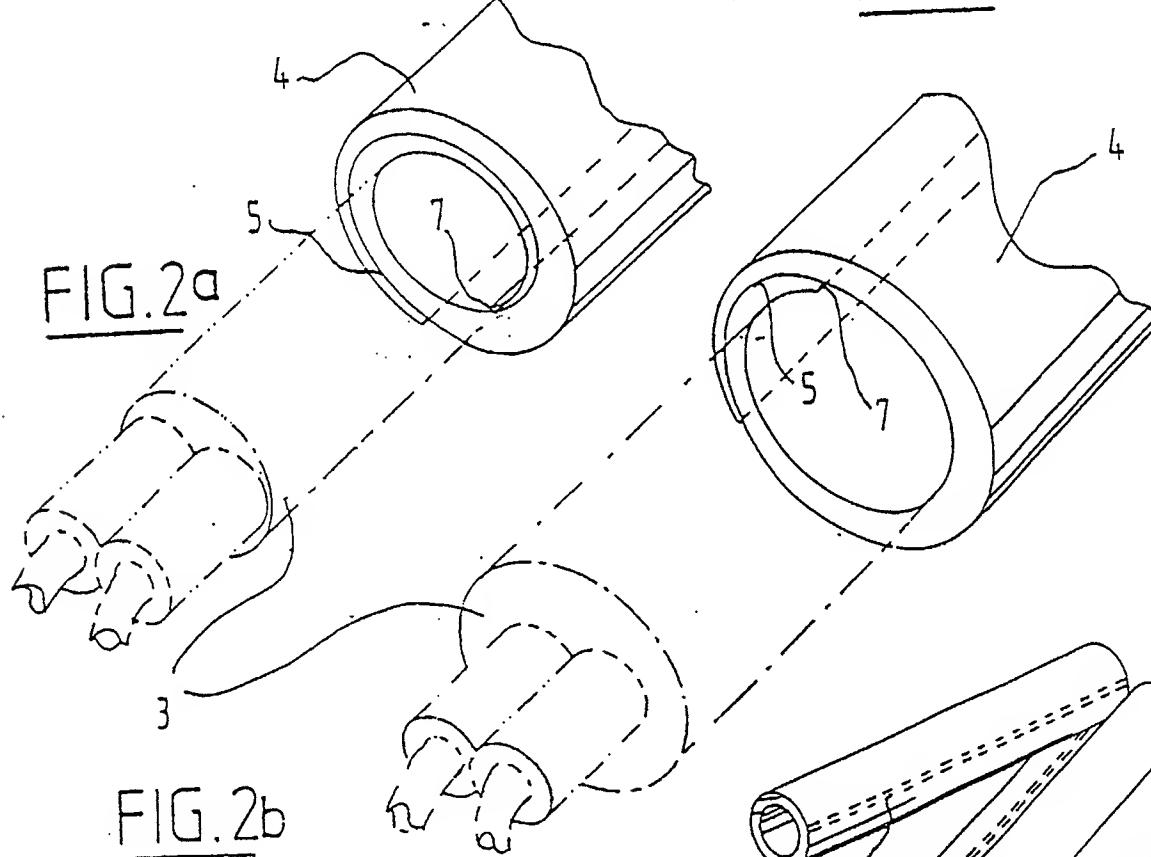
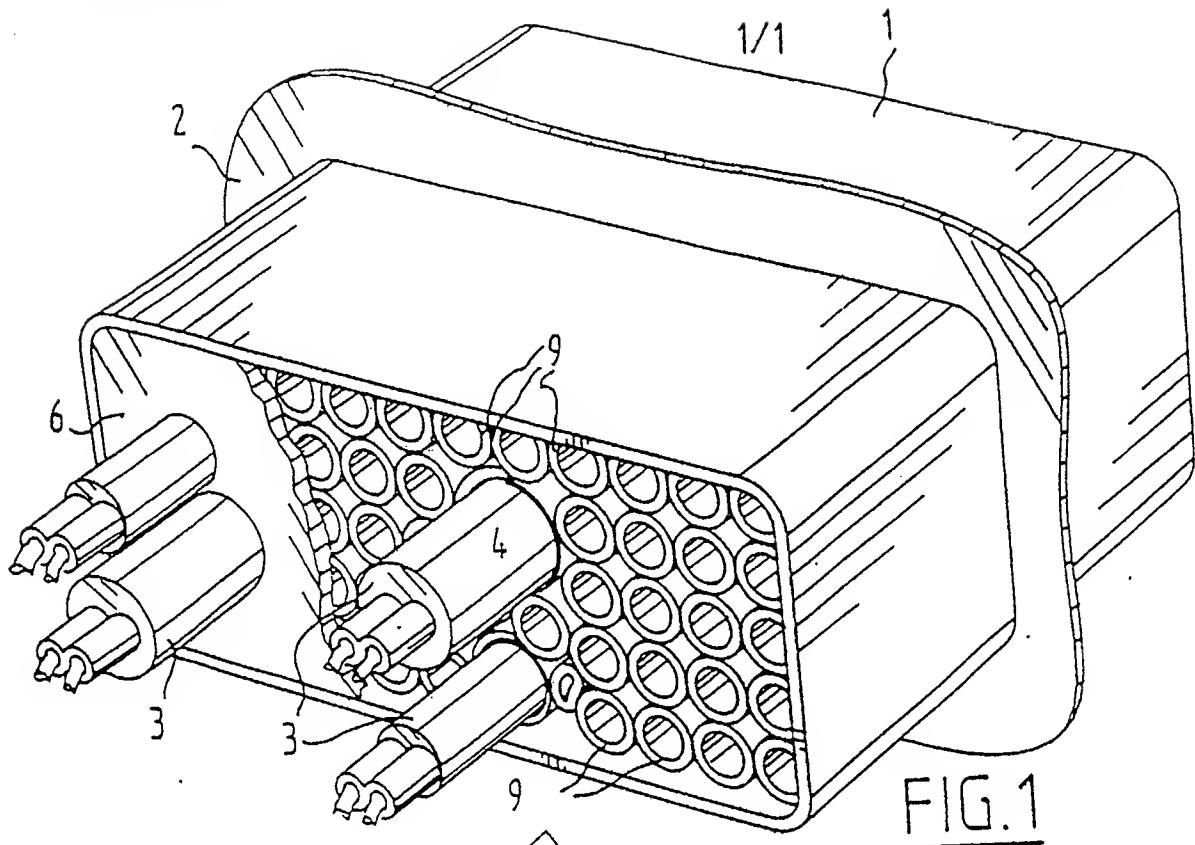
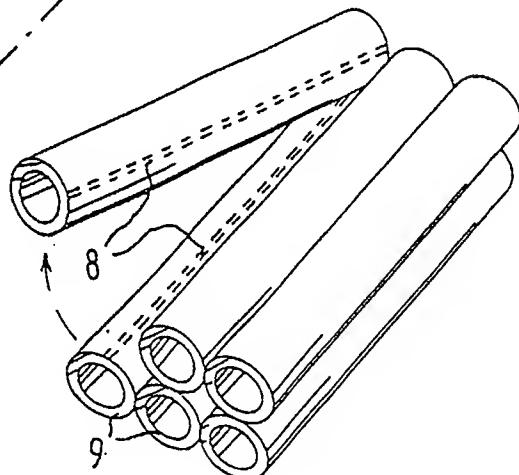


FIG. 3



## INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER  
 IPC 7 A62C3/16 H02G3/22 F16L5/04

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
 IPC 7 A62C H02G F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 5 465 759 A (CARLSON DOUGLAS W ET AL) 14 November 1995 (1995-11-14) ----	
A	DE 197 25 301 A (SCHIANO PETER) 14 January 1999 (1999-01-14) ----	
A	DE 37 24 744 A (MINNESOTA MINING & MFG) 2 February 1989 (1989-02-02) ----	

Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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